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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION II

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SUBJECT: Screening Level Ecological Risk Assessment for Cornel Dubilier

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As you requested, we have reviewed the existing data for the Cornel Dubilier Electronics Incorporated site, located in South Plainfield, Middlesex County, New Jersey. We provide the following screening level ecological risk assessment for this site.

The Cornel Dubilier site is currently being addressed through the initial stages of the removal process, so extensive knowledge of the magnitude and extent of contamination is not available. Activities at the site included work with electrical transformer oils. It is believed that uncontrolled dumping of transformer oil and burial of tranformers contributed to the presence of contamination in site-related media, including Aroclor-1254. Analytical data contained in the "Site Inspection Prioritization Evaluation," prepared by Malcolm Pirnie, Incorporated, and dated January 23, 1995, were used as the basis for this assessment. Cursory field observations were made by the USEPA (memorandum to file, dated May 21, 1996), but health and safety concerns due to the undefined extent of contamination precluded extensive field work. Habitat associated with the site includes the developed and active terrestrial portion of the site proper, the narrow stream corridor adjacent to the site, and the stream, with associated wetlands and floodplains, upstream and downstream of the site.

Consideration of the potential for ecological risk at the site was divided into two components: the terrestrial risk associated with the developed portion of the site, and the aquatic risk associated with the adjacent stream. While contaminants appear to be significantly elevated on the developed portion of the site, effort was not expended to assess the terrestrial risk because it appears that the terrestrial areas on the site proper offer extremely limited habitat value and are actively used for ongoing human activities (i.e., primarily unvegetated areas used for parking and maneuvering of vehicles on a daily basis). However, it should be noted that there is still concern that these areas will continue to act as a source of contaminants to areas likely to contain ecological receptors (e.g., the stream). As no data are available for the ecologically valuable wetland and floodplain habitats associated with the stream, the results of the assessment of the stream will be viewed as representative of these adjacent, sensitive environments.

This initial review of the available data appears to indicate that there is the potential for ecological risk from PCBs, PAHs, and inorganics contained in stream sediments and surface waters. The potential for impacts directly to the benthic community and aquatic community is indicated by the screening results. Modeling of exposure of higher trophic level receptors to contaminants through the food chain also indicates that there is a potential for impacts. It is recommended that additional activities be conducted to address the potential ecological risk associated with contamination of the stream adjacent to the site.

The initial step in this screening level ecological risk assessment was the comparison of the analytical results from the available sampling to appropriate ecological screening values for the stream media (Table 1). For sediments, Persaud's Ontario screening values were used, as they provide a relevant database for freshwater systems (D. Persaud, et al. August 1993. "Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario." Ontario Ministry of Environment and Energy.). Two measures of the magnitude of a potential effect were used from these screening values. The more conservative value used in this assessment is the Lowest Effect Level (LEL). A concentration higher than a LEL indicates that a contaminant has exceeded a concentration "that can be tolerated by the majority of benthic organisms" (Persaud, page 2). The less conservative value used is the Severe Effect Level (SEL), which is a concentration "...that would be detrimental to the majority of benthic species" (Persaud, page 2). A concentration exceeding a SEL is of more concern as it indicates a greater magnitude of potential risk. Screening against the Ontario values indicates that Aroclor-1254, cadmium, copper, lead, manganese, benzo(g,h,i)perylene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene all exceed their respective SEL in the stream sediments. For the organic compounds, this screening assumes a conservative 1% total organic carbon content (TOC) in the sediments, as the organic SEL values are adjusted based on TOC to reflect the bioavailability of the contaminants. Of the sediment contaminants exceeding a SEL, Aroclor-1254 appears to be clearly site-related, while the inorganics and PAHs may be site-related. PAH and inorganic contaminants can be wide-spread in a developed watershed such as the one associated with the site. However, most of the contaminants exceeding SELs appear to also be associated with elevated concentrations in the site soil and, in the case of the PAHs, potentially associated with known site disposal practices (i.e., transformer oils).

The initial screening against the Ontario values indicates that contamination of stream sediments adjacent to, and apparently associated with, the site are present at levels that have been linked to adverse impacts to benthic organisms in other freshwater systems. Adverse impacts associated with the potential direct toxicity could include acute effects which may eliminate some or all species, or chronic effects which may reduce abundance or diversity of the benthic populations. If such a direct toxicity impact is occurring, it may result in a disruption of both the aquatic and terrestrial food chain, as these systems are closely linked in a stream of this size (e.g., emergent insects consumed by terrestrial insectivores, fish consumed by terrestrial piscivores, or invertebrates and amphibians consumed by terrestrial omnivores/carnivores). An additional concern is that even if the contaminants are not directly toxic to the benthic organisms but do accumulate in their bodies, then impacts to benthic organisms may also result in adverse impacts to other ecological receptors. This may occur if the contaminant concentration gradient drops (e.g., moving away from the site), as there then may be an area of undefined proportions where the effects are not acutely toxic, but may cause chronic impacts and/or allow the contaminants to enter the food chain and threaten higher trophic level organisms (e.g., carnivorous, piscivorous, or insectivorous wildlife). This is of particular concern due to the bioaccumulative properties of PCBs.

While the most elevated concentrations of contaminants in aquatic media appear to have been detected in the sediments, potentially site-related contaminants were also detected in the surface water of the stream adjacent to the site. The available analytical data for the surface water were screened against the USEPA's Ambient Water Quality Criteria (AWQC) for surface water (Federal Register/Vol. 57, No. 246/Tuesday, Dec. 22, 1992/Rules and Regulations, p. 60911; and as revised for specific metals by Federal Register/Vol. 60, No. 86/Thursday, May 4, 1995/Rules and Regulations, p. 22228). Aroclor-1254 and Aroclor-1248 were present at concentrations that exceed continuous (chronic) exposure values. Unfortunately, there are no acute AWQC values for PCBs to use for comparison. Concentrations also appear to exceed maximum (acute) exposure values for cadmium, copper, lead, and zinc. The acute values for the inorganics should be adjusted for water quality parameters (e.g., hardness) that were not included in the available data. Mercury was the only other inorganic surface water contaminant that appeared to be elevated, exceeding the AWQC chronic value.

This initial comparison of sediment and surface water contaminant levels to available screening values indicates that there is a potential for acute direct toxicity impacts to wildlife associated with the aquatic habitat. Due to potential for the inorganics to enter the food chain, there is also the concern that these contaminants may have the potential to impact higher trophic level receptors. The presence in the stream of herptiles and fish, and of mammalian and avian predators in the stream corridor (i.e., raccoon, great blue heron, Coopers hawk, and red-tailed hawk; see May 21, 1996, field observations) indicates that the exposure pathway from stream sediments to upper trophic level consumers appears to be complete. Therefore, the potential for site-related contaminants to impact higher trophic levels through the food chain was selected as the assessment endpoint.

Aroclor-1254, cadmium, copper, and lead were selected as the contaminants of concern (COCs) for the initial assessment of risk to higher trophic levels because all were detected at levels associated with potential acute effects in both sediment and surface water (where acute values were available). These contaminants are also known to be bioaccumulative (PCBs) or to be less readily regulated in the organism (cadmium, copper, lead). Zinc and the four PAHs were not assessed because, while they were also detected at concentrations associated with potential acute direct toxicity effects, they have a much lower potential for bioaccumulation due to the ability of organisms to regulate their concentration (zinc) or metabolize the contaminant (PAHs).

Raccoon prints were noted in stream sediments during the field visit. Raccoons would also be anticipated to use the habitat available in the stream corridor; they are an upper trophic level consumer that forages in the aquatic food chain, including consumption of crayfish, snails, reptiles/amphibians, and fish (Wildlife Exposure Factors Handbook (WEFH), EPA/600/R-93/187a, December 1993). Raccoons were selected to act as the surrogate receptor for mammals.

The substrate and banks throughout most of the stream corridor appear to offer appropriate habitat in which crayfish would be anticipated to occur. Additionally, crayfish have life cycles and foraging habits that tie them intimately to the stream sediments (i.e., aquatic life stages, sediment burrowing, consumes detritus and invertebrates associated with the sediment), indicating a high potential for significant exposure to and uptake of sediment contaminants. Crayfish were not observed in the stream during the field visit; however, they were not searched for due to sediment contaminant levels (i.e., health and safety concerns). Therefore, crayfish were selected as the surrogate for all aquatic prey of the raccoon. The potential for contaminants from the stream sediments to impact the raccoon through the ingestion of crayfish was selected as the exposure route assessed.

Exposure of the raccoon was modeled in a conservative manner to exclude the possibility of prematurely dismissing the potential for risk to exist in the field. Additional data would be required to more precisely define the level of risk or to select an ecologically-based cleanup goal, if required. Conservative assumptions included the use of the crayfish ingestion to represent all aquatic forage in the raccoon diet, that all of the crayfish (aquatic forage) in the raccoon's diet were associated with the site sediments, that the crayfish existed in sediments with a concentration equal to the highest detected value for each contaminant, the use of lowest reported body weight for the adult raccoon, and the conservative estimate of crayfish bioaccumulation factors (BAFs). The following formula was used to estimate the exposure of the raccoon:

$ED_{RCCN} = [(C_{SED} * BAF_{CRAY} * P_{CRAY} * IR_{RCCN}) + (C_{SED} * P_{SED} * IR_{RCCN})] * 1/BW_{RCCN}$; where

ED_{RCCN} is the exposure dose of the raccoon (mg COC / kg BW_{RCCN} / day),
C_{SED} is the concentration of the COC in the sediment (mg / kg),
BAF_{CRAY} is the bioaccumulation factor for the crayfish for the COC,
P_{CRAY} is the percent of the raccoon's diet consisting of crayfish (26 %; WEFH),
IR_{RCCN} is the daily intake rate of the raccoon (1.2644 kg / day; WEFH),
P_{SED} is the percent of the raccoon's diet consisting of crayfish (9.4 %; WEFH),
BW_{RCCN} is the body weight of the raccoon (3.67 kg; WEFH).

The formula was calculated for each of the COCs to obtain the ED, then each ED was compared to a benchmark dose for that COC. The toxicity data used in this screening level ERA were obtained from an ERA prepared by the U.S. Fish and Wildlife Service for a Federal Facility in New Jersey (USFWS. April 1996. "Environmental Contaminants Impact Analysis and Ecological Risk Assessment for the Federal Aviation Administration Center CERCLA Sites in Atlantic County, New Jersey."). It was not possible to obtain the original references for the benchmark doses within the framework of this screening level ERA. Two of the benchmarks, those for cadmium and copper, were based on impacts to the liver. One of the consideration in the selection of these benchmark doses was that the potential mechanism of impacts from PAHs, which were not assessed, would be expected to include the liver, where they are often metabolized in vertebrates. The benchmark dose selected for cadmium was the lowest value from a range of experimental exposure dose concentrations reported as causing liver necrosis in rats (1.6 mg / kg BW / day). The benchmark for copper was selected from an experimental exposure dose (as copper sulfate) that resulted in hepatic inflammation and forestomach hyperplasia in rats (28 mg / kg BW / day). The other two benchmarks doses, for Aroclor-1254 and lead, were based on impacts to reproduction and population. The benchmark dose for Aroclor-1254 was based on an experimental exposure dose that caused reproductive failure in ferrets (4.8 mg / kg BW / day). The benchmark dose for lead was based on an estimated exposure dose in the field that was believed to be responsible for reduced populations of otters (2 mg / kg BW / day).

Specific BAFs for estimating crayfish tissue concentrations from sediment concentrations for the COCs could not be located. The BAFs used for the crayfish were calculated from sediment contaminant and invertebrate tissue residue data contained in the previously referenced USFWS ERA and a study from a site on the Raritan River (Normandeau Associates. February 1996. "Biota Monitoring Study Kin-Buc Landfill Operable Unit 2 1995."). On the one hand, the calculations can be advantageous over laboratory data because the BAFs obtained are based on field observations rather than laboratory investigations, thereby potentially decreasing the uncertainty. On the other hand, this may increase the uncertainty to some extent because the calculations use different species than the crayfish, with potentially different lipid contents, foraging techniques, habitats, etc., and the comparability of the TOC and grain size data between the site and study sediments is unknown. For Aroclor-1254, data from analysis of sediment and fiddler crab tissue for Aroclor-1248 were used to calculate the BAF of 2.931 (a mean of tissue/sediment ratios from 17 stations). For cadmium, a BAF of 0.117 was calculated from caddisfly larva tissue and sediment data from a single station. Calculations for copper used data from seven stations for dragonfly larva tissue and sediments, resulting in a BAF of 0.913. For lead, caddisfly larva results were again used to calculate a BAF of 0.061 based on five stations.

The Hazard Quotient (HQ) for for each COC was calculated by dividing the ED by the benchmark dose. If the ED divided by an appropriately conservative benchmark dose yields a HQ less than 1, then little or no potential for ecological risk should exist. If the HQ is greater than 1, then there is a potential for ecological risk. The HQs were also summed to generate a Hazard Index (HI) to assess the potential for cumulative risk from all of the COCs assessed, which may or may not individually generate risk (i.e., have a HQ greater than 1). Aroclor-1254 and lead each generated a HQ greater than 1, while cadmium and copper did not (Table 2). In agreement with the process in the ecological risk assessment document recommended by the Region II BTAG, the review draft "Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments" (U.S. Environmental Protection Agency, Environmental Response Team, Edison, NJ, September 26, 1994, Review Draft), the next step in the assessment of ecological risk should be to conduct site specific investigations to confirm whether or not impacts are occurring in the field, and to define the extent and significance of ecological impacts. Therefore, the appropriate conclusion for a screening level assessment of ecological risk such as this is that there is not adequate information at this stage to eliminate the potential for ecological risk. Further investigations should be conducted to adequately assess ecological risks associated with this site.

The nature of a screening level ERA and the limited data available for this site precludes definitive conclusions regarding the significance of any effects that may actually be occurring in the field. However, the uncertainties can be clarified so that any risk management decisions that must be made can be as informed as possible. The following are, first, factors which may decrease the uncertainty or increase the potential that significant ecological effects may be occurring in the field and, second, factors which are common to screening level assessments that may increase the uncertainty.

While neither cadmium nor copper generate a HQ greater than 1, these two COCs do generate a HI greater than 1 when summed. This is of concern because, as previously noted, the mechanism of both benchmark doses involves liver effects. The impact of cadmium and copper together may still potentially generate risk, especially when qualitatively considered along with the potential for liver effects from the PAHs, which were not assessed. This also points out that only Aroclor-1254, cadmium, copper, and lead were assessed for potential impacts to higher trophic level organisms, while other site-related contaminants may contribute to the overall risk to ecological receptors in the field. Each comparison of a maximum stream sediment concentration to an Ontario value indicated that the concentration exceeded the LEL. Although this may potentially indicate watershed contamination rather than site-related contamination, it does indicate that the aquatic system is probably under stress, regardless of the source, and may therefore be more susceptible to significant ecological effects that may be associated with the site. Finally, it is typically recommended that the benchmark doses be based on no observable adverse effect levels (NOAELs), or at least lowest observable adverse effect levels (LOAELs), to be appropriately conservative to support the dismissal of the potential for risk if a HQ of less than 1 is calculated. As this screening level ERA was being prepared as part of a removal investigation, less conservative benchmarks were used and, where possible, shorter term exposures were selected. This should indicate that if potential ecological risk is found in the assessment, then there may be a higher probability that effects are actually occurring in the field. It may also mean a higher probability that any effects that are occurring in the field may be significantly adverse effects. The use of the less conservative benchmark was intended to reduce the uncertainty of the ERA. This was done to facilitate supporting risk management decisions associated with potential removal actions; decisions that often must be made even if conducting extensive field investigations and confirmatory studies is not feasible.

The AWQC for surface water can be influenced by site-specific parameters. Hardness and pH are examples of parameters that can influence the bioavailability and/or toxicity of contaminants in the surface water. These parameters were not available for use in this assessment, so the comparison to the AWQC may actually include more or fewer exceeded values. Grain size distribution, total organic carbon content, reduction-oxidation potential, pH, and other factors can influence the bioavailability and/or toxicity of contaminants in the sediment. Without these parameters, the actual availability of the sediment contaminants to biological receptors is unknown, regardless of the indications of screening values. The examination of the food chain evaluated only raccoon consumption of a single prey item (i.e., crayfish) assumed to be obtained exclusively from a maximally contaminated area, which would not be likely in the field. While the percent aquatic forage consumed in the raccoon diet was adjusted for average foraging habits, the prey items consumed would not to be likely to all originate adjacent to the site in the area of highest contamination. The food chain model assumed that the benchmarks that had been derived for other mammalian species can be applied directly to the raccoon. The toxic effect of these contaminants may be either more or less than these benchmarks. As previously noted, the BAFs were calculated from different invertebrates with potentially different foraging techniques and habitats. This could combine with the differences in the physical parameters between this site and the sites from which the BAFs were calculated to increase or reduce the BAFs. All of these factors contribute to the uncertainty of this assessment of ecological risk; however, it should be noted that these uncertainties influence the results in both directions (i.e., more and less conservative).

The habitat value of the aquatic, wetland, and floodplain habitat immediately adjacent to the site does not appear to be high based on the preliminary, cursory field investigation (i.e., heavily developed, steep and high banks, no significant floodplain or wetlands). However, what appear to be very diverse and valuable habitat exist just upstream and downstream of the site in the form of forested and emergent wetland, floodplain, old field and meadow, and undeveloped watershed in an otherwise heavily developed region. This physical arrangement could potentially have the affect of attracting ecological receptors into the areas of higher quality habitat, then exposing them to the contamination through either the use of the stream adjacent to the site as a migration corridor or the transport of contaminants from adjacent to site to downstream habitats. Based on this potential and the results of this screening level ERA, it is our recommendation that additional activities be conducted to address the contamination of the stream sediments. If additional ecological investigations cannot be performed, then due to the relatively lower value of the habitat adjacent to the site and the potential for highly toxic and/or bioaccumulative contaminants to be transported off of the site, it may be appropriate for the areas of highest stream sediment contamination (hot spots) to be removed. Any such action may serve to reduce the potential ecological risk and serve to protect the environment.

We hope these comments have been helpful. The BTAG and/or ESD is interested in reviewing any future documents pertaining to this site. If you have any questions, comments, or require further information, please contact Christopher Stitt at (908) 321-6676.

Attachments

TABLE 1.	CORNELL DUBILIER ELECTRONICS : MEDIA CONTAMINANT CONCENTRATIONS							
	JAN. 1995 SIP	LEL	SEL		JAN. 1995 SIP	EPA	AWQC	(unfiltered)
	max sed. - ppm	ppm	ppm		max SW - ppb	chronic	acute	
antimony	6.1							
arsenic	24.2	6.0	33.0		15.6	190.0	360.0	
cadmium	24.8	0.6	10.0		14.5	1.1	3.9	
chromium	56.6	26.0	110.0		25.7	210.0	1,700.0	(as III)
copper	219.0	16.0	110.0		89.6	12.0	18.0	
iron	31,400.0	20%	40%		19,600.0			
lead	552.0	31.0	250.0		180.0	3.2	82.0	
manganese	1,610.0	460.0	1,100.0		1,380.0			
mercury	0.77	0.2	2.0		0.23	0.012	2.4	
nickel	52.4	16.0	75.0		40.8	160.0	1,400.0	
silver	6.9				3.8		4.1	
zinc	798.0	120.0	820.0		994.0	110.0	120.0	
	ppb	ppb	ppb					
			@1%TOC					
1,2-dichloroethylene	51.0				100.0			
trichloroethylene	120.0				2.0			
vinyl chloride					3.0			
acenaphthylene	220.0							
acenapthene	830.0							
anthracene	830.0	220.0	3,700.0					
benzo(a)anthracene	4,000.0	320.0	14,800.0		1.0			
benzo(a)pyrene	5,900.0	370.0	14,400.0					
benzo(b)fluoranthene	8,200.0				2.0			
benzo(g,h,i)perylene	4,500.0	170.0	3,200.0					
benzo(k)fluoranthene	4,600.0	240.0	13,400.0		0.6			
bis(2-ethylhexyl)phthalate	54,000.0							
butylbenzylphthalate	8,100.0				3.0			
carbazole	650.0							
chrysene	5,100.0	340.0	4,600.0		2.0			
dibenz(a,h)anthracene	2,200.0	60.0	1,300.0					
dibenzofuran	380.0							
di-n-butylphthalate	280				0.2			
di-n-octylphthalate	7,600.0							
fluoranthene	7,700.0	750.0	10,200.0		2.0			
fluorene	540.0	190.0	1,600.0			(shading indicates a SEL or an		
indeno(1,2,3-cd)pyrene	4,700.0	200.0	3,200.0			acute AWQC was exceeded)		
2-methylnaphthalene	450.0							
phenanthrene	4,000.0	560.0	9,500.0		1.0			
pyrene	6,000.0	490.0	8,500.0		2.0			
1,2,4-trichlorobenzene	5,400.0							
Aroclor-1248					24.0	0.014		
Aroclor-1254	550,000.0	60.0	340.0		20.0	0.014		

TABLE 2. CORNEL DUBILIER ELECTRONICS : RISK CALCULATIONS FOR THE RACCOON

MAXIMUM Sediment Concentration

COC	ediment Conc. (Csed)	Crayfish BAF (BAFcray)	% Crayfish (Pcray)	% Sediment (Psed)	Ingest. Rate (IRrccn)	Body Weight (BWrccn)	DOSE (ED)	Benchmark Dose	HQ
	mg/kg				kg/day	kg	mg/kgBW/day	mg/kgBW/day	
Aroclor-1254	550.00	2.931	0.26	0.094	1.2644	3.67	162.21	4.80	33.79
cadmium	24.80	0.117	0.26	0.094	1.2644	3.67	1.06	1.60	0.66
copper	219.00	0.913	0.26	0.094	1.2644	3.67	25.00	28.00	0.89
lead	552.00	0.061	0.26	0.094	1.2644	3.67	20.89	2.00	10.45
								TOTAL HI	45.80

SEDIMENT CALCULATION: [(Csed*BAFcray*Pcray*IRrccn)+(Csed*Psed*IRrccn)]*1/BWrccn=ED